GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester - VIII
Course Title: Ship Building and Ship Recycling
(Course Code: 4385506)

Diploma programmer in which this course is offered	Semester in which offered
Fabrication Technology	Eight

1. RATIONALE

The proposed syllabus on shipbuilding and ship recycling will be helpful to students to understand the construction and ship recycling process. By focusing on ship recycling, the syllabus addresses growing environmental concerns and regulatory changes. Students will be equipped with the skills to navigate the complexities of design, construction, and disposal of vessels, making them valuable contributors to shipyards, naval architecture firms. This comprehensive approach ensures that students not only gain technical proficiency but also cultivate environmental consciousness and adaptability, preparing them for diverse and impactful careers in the maritime sector.

2. COMPETENCY

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency:

- **Describe the constructions, inspections, painting and coating in ship building industry and Learn recycling importance and how it is help to save environment and energy.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

i. Describe the ship and codes and standards used for ship construction.
ii. Describe the Ship hull construction, pre fabrication and erection & ship drawing.
iii. Describe the Welding, cutting and forming process of ship building and ship recycling.
iv. Describe Ship recycling, breaking and ship coating treatment.
v. Describe the Ship inspection & launching of ship.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
4	0	2	5	30*	70	25	25	150

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

***Legends: L**-Lecture; **T**– Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** -End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the sub-components of the COs. *These PrOs need to be attained to achieve COs.*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Prepare a neat sketch of typical ship model drawing and label all its elements from given model.	1	2
2	Draw typical drawing of ship.	1	2
3	Prepare a typical ship model anyone having following components (keel, side frame, longitudinal frame, bulk head, deck, midship, forepeak, aft peak, rudder, propeller, side plating, super structure etc.	2	14
4	Prepare a report on safety related to welding and cutting process used in ship construction and ship breaking.	3	2
5	Demonstrate the typical ship painting process.	3	2
6	Demonstrate the typical ship launching arrangement for ship launching. And Study of typical ship trial.	3	2
7	Prepare typical ship recycling yard layout plan and label its various elements.	4	2
8	Prepare report on hazardous materials in ship recycling	5	2
	TOTAL HOURS.		**28**

Note :

*i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

ii. Boiler suit, safety shoes & other safety items are compulsory while attending laboratory and has to be brought by students. (annexure-1)

The following are some sample 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed Practical Exercises of this course required which are embedded in the COs and ultimately the competency.

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
For PrOs no: 1,2,4,5,6,7,8		
1	Knowledge of experiment	20
2	Performance	30
3	Procedure followed	30
4	Quality of report	10
5	Punctuality	10
Total		**100**

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
For PrOs no: 3		
1	Knowledge of experiment	30
2	Quality of report	30
3	Participation	20
4	Punctuality	10
5	Originality	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipment with broad specifications for the PrOs are guide to procure them by the administrators to user in uniformity of practical's in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1.	Stationary and other drawing instruments	All
2.	Bench Vice, Cutting Hacksaw	3

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this course competency.

a) Follow safety practices in laboratory.
b) Practice good housekeeping.
c) Work as a leader/a team member.
d) Maintain tools/equipment
e) Follow ethical practices

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year& 4th year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for *development* of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit-I Introduction to ship	1a. Describe the ship parts 1b. Describe classification of ship building 1c. Describe the various scientific laws related to ship building 1d. Classify the society of classification	1.1 Definition of ship building 1.2 Introduction to Ship 1.3 Shipbuilding Process 1.4 Classification of Ship Based on various Criteria 1.5 Ship Dimension Principal 1.6 Specification of various types of ship 1.7 Terminology of ship building / Glossary 1.8 Comparisons of Steel and FRP ship 1.9 MISC Scientific/rules related to Ship 1.9.1 Newton's Third Law of motion 1.9.2 Archimedes Law of Buoyancy 1.9.3 PASCAL's Law of Fluid Pressure 1.9.4 Law of Fluid displacement and weight of displaced fluid 1.10 Soft and Hard Skill Requirement of Ship Building Supervisor 1.11 Introduction to Dry Cargo Ship, Bulk Carrier, Oil Tanker, Passenger Ship 1.12 Prepare a C.V. Ship Building Engineer 1.13 Classification Society Its Classification
Unit – II Ship drawing and ship construction	2a. Describe ship yard layout 2b. Describe the material selection criteria 2c. Describe loft work 2d. Describe keels 2e. Describe bottom structure 2f. Describe bulk heads 2g. Describe ship outfit modules	2.1 Ship drawing 2.2 Ship design (design spiral) 2.3 Material Selection Criteria for Ship 2.4 Ship design Consideration for various types of stress 2.5 Ship Yard Layout 2.6 Line plan 2.7 Shell expansion 2.8 Loft work 2.9 Definition of keels 2.10 keels Classification/ Different Types 2.11 Keel laying and Sequential Frame Structure Erection 2.12 Ship Hull Block Construction Methods 2.13 Building Block Erection drawing 2.14 Types of Bottom Structure 2.15 Classification of Frame on various bases 2.16 Bulk heads 2.17 Ship and shell Plating 2.18 Decks 2.19 Ballast tank 2.20 Water tight bulk head 2.21 Construction of tank 2.22 Ship outfit modules in ship construction/erection.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
UNIT– III **Welding, cutting process of ship building and ship recycling**	3a. Describe the cutting process used in ship building and ship recycling 3b. Describe under water welding 3c. Compare welding process SMAW & GMAW 3d. Compare GTAW & GMAW	3.1 Cutting process used in ship building and ship recycling 3.2 Slot Welding & doubler plate 3.3 Ship Welding Practices 3.4 Ship Welding Sequences 3.5 Under water welding 3.6 WPS /PQR/WPQ for welding process used in ship building. 3.7 Comparison arc welding process SMAW & SAW 3.8 Comparison GTAW & GMAW 3.9 Types of welding discontinuities
Unit -IV **Ship recycling , breaking and ship coating treatment**	4a. Describe the concept of ship recycling 4b. Describe process of ship breaking 4c. Describe ship dismantling process 4d. Describe environmental issues in the disposal methods 4e. Describe the roles of G.P.C.B. 4f. Describe the factors affecting ship life	4.1 Definitions & Introduction of ship recycling Meaning Concept of Ship Recycling 4.2 Ship Recycling yard lay-out 4.3 Ship recycling scenario 4.4 Age profiles of different categories of ship. 4.5 Merit/ advantages of ship recycling / breaking 4.6 Process of ship braking 4.7 Locations & concern area of ship braking 4.8 Ship braking/ dismantling process 4.9 Disposals of material an hazards materials (Hazardous west disposal methods) 4.9.1 Environmental issues in the disposals of hazards materials 4.9.2 Dangerous of ship braking 4.9.3 Safety and health in ship braking / Safety in Ship Recycling 4.9.4 List OUT THE Requirement OF tools/equipment accessories to prevent Accident for Safety 4.10 Role of G.P.C.B 4.11 Factor affecting Ship Life 4.12 Material Handling in Ship 4.13 REPORTING OF Different types of Accident Occurs in Ship Recycling 4.14 Precautionary measures in Ship Recycling 4.15 Basic requirement of fire fighting in ship 4.16 Ship Coating 4.17 Various Methods of Coating 4.18 Definition of Paint 4.19 Types of paint

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
		4.20 Classification various methods & painting application
Unit -V **Ship inspection & launching of ship**	5a. Describe the ship inspection methods 5b. Describe the various type of launching of ship 5c. Describe the various type of ship trials	5.1 Ship Launching 5.1.1 Definition & of Ship Launching 5.1.2 Classification of various types of launching 5.1.3 Introduction of various types of launching method 5.1.4 Typical case studies of 75000 bulk carrier. 5.2 Ship Trials 5.2.1 Definition, Introduction and meaning of ship trial 5.2.2 Classification of Trials 5.2.3 Activities Before During & after Trial 5.2.4 Acceptance of Trial and Inspection of ship 5.2.5 Schedule of Trials 5.3 Ship testing 5.3.1 Ship Inspection, Raw Material Inspection 5.3.2 Non Destructive Testing

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to ship	**8**	4	7	0	**11**
II	Ship drawing and ship construction	**18**	7	13	0	**20**
III	Welding, cutting process of ship building and ship recycling	**8**	3	7	0	**10**
IV	Ship recycling , breaking and ship coating treatment	**12**	7	7	5	**19**
V	Ship inspection & launching of ship	**10**	3	7	0	**10**
	TOTAL	**56**	**24**	**41**	**5**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*
Note: *This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks and marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports/charts for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a. Prepare sketchbook of drawing of various topics of syllabus
b. Prepare a question bank.
c. 10 min PPT presentation on the given topic from the syllabus or beyond the syllabus
d. Report writing on various topics from syllabus and beyond syllabus
e. Prepare a model of ship.
f. Download the various ship building and ship recycling videos.
g. Download the various ship launching videos.
h. Download the various ship painting videos.
i. Prepare a various frame drawing using AutoCAD.
j. Prepare a report on the topic mentioned in table 8.9.1
k.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide student(s) in undertaking micro-projects.
c) ***'L' in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based (group of 3 to 5). However, **in the fifth and eighth semesters**, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the micro project should be about **14-16** ***(fourteen to sixteen) student engagement hours*** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a. **Prepare a quiz on Ship building and ship recycling**
b. **Chart making:** Prepare the charts on different topic given by faculty.
c. **Video Preparation:** Student has to prepare his/her video on explaining different topics of subjects given by faculty.
d. **E-learning projects:** Students have to use internet and other online resources for preparation of report and/or download video on the topic given by the subject teacher within the syllabus or beyond the syllabus.
e. **Report preparation:** Student has to use different books, technical magazine, journals etc. for preparation of a report on the topic given by the subject teacher within the syllabus or beyond the syllabus.
f. **Power point presentation**: Students has to prepare a power point presentation of 10 to 15 slides on the topic given by the subject teacher within the syllabus or beyond the syllabus. In the end of presentation student has to ask at least 3 to 5 MCQ based question to identify the gain of listeners at the end presentation.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Merchant ship Construction	D. A. Taylor	Butterworth, 1980
2	Ship Design and Construction	R. Taggart	Society of Naval Architects and Marine Engineers, 1980
3	Ship Construction	D. J. Eyres	Butterworths & Heinemann
4	Naval Architecture for marine engineers	W. Muckle Eric C. Tupper	Butterworths & Heinemann
5	Rules and regulations for Constructions and Classification of steel ship	IRS	Indian Register Of Shipping
6	American Bureau of shipping (Rules Books)	ABS	American Bureau Of Shipping
7	Ship Recycling A Handbook for Mariners	Purnendu Misra Anjan Mukherjee	Narosa Publishing House
8	Ship Stability for Masters and Mates	Captain D.R.Derrett Dr. C. B. Barrass	Butterworths & Heinemann

14. SOFTWARE/LEARNING WEBSITES

1. https://en.wikipedia.org/wiki/Shipbuilding
2. https://www.imo.org/en/ourwork/environment/pages/ship-recycling.aspx
3. https://www.youtube.com/watch?v=acW-DG1OCDk

15. PO-COMPETENCY-CO MAPPING

Semester VIII	Ship Building and Ship Recylling (Course Code : 4385505)						
	POs						
Competency & Course Outcomes	**PO 1 Basic & Discipline specific knowledge**	**PO 2 Problem Analysis**	**PO 3 Design/ development of solutions**	**PO 4 Engineering Tools, Experimen-tation &Testing**	**PO 5 Engineering practices for society, sustainability & environment**	**PO 6 Project Manage-ment**	**PO 7 Life-long learning**
Competency	• **Describe the constructions, inspections, painting and coating in ship building industry and Learn recycling importance and how it is help to save environment and energy.**						
CO1. Describe the ship and codes and standards used for ship construction	3	-	1	-	1	-	1
CO2. Describe the Ship hull construction, pre fabrication and erection & ship drawing.	3	-	2	-	1	-	1
CO3. Describe the Welding, cutting and forming process of ship building and ship recycling.	3	-	2	-	1	-	1
CO4. Describe Ship recycling, breaking and ship coating treatment.	3	-	1	-	1	-	1
CO5. Describe the Ship inspection & launching of ship.	3	-	1	-	1	-	1

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
1.	Mr. Ashoksinh M. Gohil *Lecturer in Fabrication Technology Department*	Sir Bhavsinhji Polytechnic Institute Bhavnagar	9924682010	amgohilges@gmail.com
2.	Mr. Nilesh M. Bhangale *Lecturer in Fabrication Technology Department*	Sir Bhavsinhji Polytechnic Institute Bhavnagar	9016926792	nileshbhangalefabtechbpi@gmail.com
3.	Mr. Parthiv T. Trivedi *Lecturer in Fabrication Technology Department*	Sir Bhavsinhji Polytechnic Institute Bhavnagar	9924185501	trivediparthivbpti@gmail.com
4.	Mr. Jasmin Bhanderi *Lecturer in Fabrication Technology Department*	Sir Bhavsinhji Polytechnic Institute Bhavnagar	9723496425	bhanderi.jasmin.bpti@gmail.com

ANNEXURE-1

❖ SAMPLE SAFETY CONTRACT:

(To be filled by the students and submitted to concerned faculty/staff)

-- *Use for reference purposes only* --

1. You have to read and sign the safety contract.
2. The safety contract says that you understand that safety is your responsibility.
3. The safety contract to be signed before you carries out any work in the laboratory and if you don't observe and obey the safety rules, you will not be allowed in the laboratory.

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Safety Contract

Date: _______________

Name of Institute: ____

Name of Course with Code: Ship building and Ship Recycling 4385505

Name of Faculty/Staff with Designation: 1. ____

2. ____

3. ____

I RECOGNIZE THAT:

1. Safety is my responsibility while using any tool or equipment.
2. Safety regulations have been provided to me.
3. The possibility of accident and injury increases if I do not follow all the safety guidelines.
4. I must act responsibly to ensure my own safety & the safety of others in the work area.

I AGREE TO:

1. Never work in the shop without my faculty's/instructor's supervision.
2. Read and practice all the safety regulations that have been distributed to me in this course or have been posted in the work areas.
3. Act in a responsible manner at all times in the laboratory.
4. Follow all instructions given by the faculty.
5. Immediately report any unsafe condition or activity to my faculty.
6. Wear eye protection at all times when working with tools or working anywhere near someone who is using tools.
7. Cut or Tie back long hair, remove jewellery, secure loosed clothing, and wear boiler suit & safety shoes in the laboratory.
8. Clean all work areas and put equipment away before leaving the laboratory.

I, ____, have read and agree with all the safety instructions.

Particulars:

Programme: __________________________ Student Signature

Batch No.: ____________________________

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Enrollment No.: ________________________